

REMARKS

Claims 11-19 and 24-28 are now pending in the application. Claims 11-19 stand rejected. Claim 11 is amended. Support for the amendments may be found in the specification as originally filed at Figures 3A and 3B, and at paragraphs [0034]-[0038]. Claims 24-28 are added. Support for the added claims may be found in the specification as originally filed at paragraph 34, as well as Figures 2 and 3, and paragraphs 30-31 and 47. Paragraphs 34, 30-31, and 47 respectively state in relevant part:

The operator or technician also uses the spot size of laser 205 to determine the minimum allowable tool pitch 330 of tool path 300A. For example, if the spot size is 10 microns, tool pitch 330 should be a maximum of 10 microns to prevent under-ablated ridges from forming along outer walls of the radial contours. A pitch size around two microns works well with the 10-micron laser spot.

... a constant arc speed tool path ... includes ... a plurality of exposure steps 320 having constant arc speed and spacing ... laser 205 pulses at a fixed repetition rate, the uniform ablation is translated into a constant propagation speed of PZT scan mirror 230 to direct the laser strike point onto exposure steps 320 of workpiece 255.

Another way to solve the same problem is to fire the laser at a faster rate when the hole radius is at the outer exposure steps. However, this approach requires additional process control that is difficult to synchronize and manage in the laser system.

The specification is amended to correct typographical errors at paragraph 40. The Examiner is respectfully requested to reconsider and withdraw the rejections in view of the amendments and remarks contained herein.

AMENDMENT TO THE SPECIFICATION

Applicant herein amends paragraph 40 of the specification to correct typographical errors.

The amendment does not add new matter. For example, paragraph 40 states in relevant part, "Another function of $V_{\max}(i + 1) = V_{\max}(i) - (\Delta V_{\max} * i)$ makes the taper progressively steeper. On the other hand, $V_{\max}(i + 1) = V_{\max}(i) - (\Delta V_{\max} / i)$ makes the taper angle less and less steep as radius is reduced". Accordingly, one skilled in the art can readily appreciate that the statement, " $V_{\max}(i + 1) = V_{\max}$ results in a constant taper with fixed taper angle" is a typographical error, and infer from context the correct statement " $V_{\max}(i + 1) = V_{\max}(i) - \Delta V_{\max}$ results in a constant taper with fixed taper angle". Moreover, one skilled in the art would readily recognize that the statements regarding the other functions are reversed, since progressively more and less rapid decrease of V_{\max} between layers respectively results in less steep and steeper taper angles. Thus, the original statements are typographical errors that are easily corrected by switching the statements regarding their effects. Accordingly, one skilled in the art can readily infer from context that the correct statements are, "Another function of $V_{\max}(i + 1) = V_{\max}(i) - (\Delta V_{\max} * i)$ makes the taper angle less and less steep as radius is reduced~~progressively steeper~~. On the other hand, $V_{\max}(i + 1) = V_{\max}(i) - (\Delta V_{\max} / i)$ makes the taper angle progressively steeper~~less and less steep as radius is reduced~~." Thus, no new matter is added.

REJECTION UNDER 35 U.S.C. § 102

Claims 11, 12, and 15-19 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Lai (U.S. Pat. No. 6,231,566). This rejection is respectfully traversed.

The teachings of Lai are generally directed toward laser beam control to accomplish surface ablation. In particular, the Examiner relies on Lai to teach a tool path of concentric rings with equal spacing between ablations in a ring, and uniform

decrease in radius between rings. For example, **column 2, lines 26-27 of Lai state, “The diameters of the rings are uniformly increased or decreased in each layer”.** Also, formulas 1 and 2 at column 4, lines 26-34 detail a uniformly changing angular progression during ablation of each concentric ring of the tool path. Accordingly, Lai does not teach application of a laser according to a non-uniformly changing radius and angular progression during the spiral, but alters radius between rings in a uniform manner, and uniformly spaces exposure steps for each ring using a constant scan speed for each ring that is uniformly varied from ring to ring as a function of a constantly changing ring perimeter, and a constant laser repetition rate.

Applicants’ claimed invention is generally directed toward a constant tool path algorithm. In particular, Applicants’ claimed invention is directed toward a continuous spiral tool path achieved by application of a laser according to a non-uniformly changing radius and angular progression during a spiral. For example, **independent claim 11 of Applicant’s claimed invention recites “application of the laser according to a non-uniformly changing radius and angular progression during the spiral”.** An example of a resulting tool path is illustrated in Figures 3A and 3B of the originally filed specification. Accordingly, Lai does not teach all of the elements recited in independent claim 11.

Applicants respectfully request that the Examiner withdraw the rejection of independent claim 11 under 35 U.S.C. §102(b), along with rejection on these grounds of all claims dependent therefrom.

REJECTION UNDER 35 U.S.C. § 103

Claims 13 and 14 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Lai (U.S. Pat. No. 6,231,566) in view of Cutler et al. (U.S. Pat. No. 5,798,927). This rejection is respectfully traversed.

For discussion of the differences between Applicants' claimed invention and the teachings of Lai, Applicants respectfully direct the Examiner's attention to remarks detailed above with respect to rejection of independent claim 20 under 35 U.S.C. § 102.

The teachings of Cutler et al. are generally directed toward a laser controller coordinating movements of stages in a multi-rate positioner system. In particular, the Examiner relies on Cutler et al. to teach a piezoelectric transducer as a scanning device that controls repetition rate and spot size and positioning by variation of applied voltage. However, Lai and Cutler et al. do not teach, suggest, or motivate application of the laser according to a non-uniformly changing radius and angular progression during the spiral. These differences are significant.

Accordingly, Applicants respectfully request the Examiner withdraw the rejection of claims 13 and 14 under 35 U.S.C. § 103(a) in view of their dependency from an allowable base claim.

NEW CLAIMS

Claims 24-28 are added. Support for the added claims may be found in the specification as originally filed at paragraph 34, as well as Figures 2 and 3, and paragraphs 30-31 and 47. Each of claims 24-28 depend directly or indirectly from allowable base claim 11 and should be allowed for the same reasons.

CONCLUSION

It is believed that all of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicant therefore respectfully requests that the Examiner reconsider and withdraw all presently outstanding rejections. It is believed that a full and complete response has been made to the outstanding Office Action, and as such, the present application is in condition for allowance. Thus, prompt and favorable consideration of this amendment is respectfully requested. If the Examiner believes that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at (248) 641-1600.

Respectfully submitted,

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